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INVENTORY AND MONITORING OF HERPETOLOGICAL COMMUNITIES ON THE KENNEDY SPACE CENTER/MERRITT ISLAND NATIONAL WILDLIFE REFUGE/ CANAVERAL NATIONAL SEASHORE

ANNUAL REPORT

INTERIM

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INTRODUCTION

Reptiles and amphibians are important yet often ignored components of terrestrial and aquatic ecosystems (Gibbons, 1988; Vitt et al., 1990). Because of their ectothermic physiology, amphibians and reptiles have extremely low energy requirements, and, consequently, may have a biomass that exceeds that of nearly all other vertebrates in aquatic and terrestrial ecosystems (Bennett and Gorman 1979; Burton and Likens, 1975; Bury et al., 1980; Pough, 1980; Bury, 1988; Gibbons, 1988; Vitt et al., 1990). Both groups are excellent indicator species of environmental degradation, amphibians because of their complex life cycle and permeable skin, and reptiles because of their frequent position as top carnivores (Duellman and Trueb, 1986; Gibbons, 1988; Vitt et al, 1990). Amphibians and reptiles also have a surprisingly high economic potential; minimum wholesale values have been estimated at over $35 million per year in Louisiana alone (Louisiana Dept. of Wildlife and Fisheries, 1992), and the value of amphibians and reptiles imported into the U. S. exceeds $400 million annually (Scott and Seigel, 1992). These characteristics have led to increasing recognition of the need for collecting better data on the biodiversity and ecology of amphibians and reptiles, both on the part of the academic community and by natural resource managers (Scott and Seigel, 1992).

Despite the increasing recognition of the ecological importance of amphibians and reptiles, it has only been within the last few years that state and federal resource management agencies have attempted to conduct quantified studies of the status, abundance, and distribution of these organisms. Such studies, usually referred to as "biodiversity studies", are very common for other vertebrates, especially birds and mammals. One of the reasons that more biodiversity studies have not been conducted for amphibians and reptiles concerns the need for long- term data to properly assess temporal variation in population abundance (e.g., Pechmann et al, 1991). Such long-term studies require a lengthy commitment of funding and manpower, commitments few federal or state agencies have been able to make.

Unlike most other federally-managed lands, there are considerable existing data on the biodiversity of amphibians and reptiles of the KSC/MINWR/CNS, mainly collected while R. Seigel was a graduate student working on the refuge in the late 1970's. These data include over 1000 records of snakes, turtles, and other amphibians and reptiles, much of it in a quantified format. Thus, unlike most other federal lands, there exists for KSC/MINWR/CNS sufficient data to begin assessment of long-term changes in biodiversity patterns of amphibians and reptiles. Given the unique habitat and protected status of the KSC/MINWR/CNS, there exists an exciting opportunity to inventory and monitor populations of reptiles and amphibians, which will add to our understanding of barrier island ecosystems. Such a program will be specifically designed to allow monitoring of populations by local personnel with only limited training.

Starting in 1992, the National Park Service (NPS) agreed to partially support the initiation of this work as part of a larger program for conducting inventory and monitoring programs on the Southeastern Coastal Parks. Some limited sampling was conducted in 1992 and 1993 using funds provided by the NPS and by Southeastern Louisiana University (SLU); these surveys resulted in the discovery of three new species for the KSC/MINWR/CNS. More intensive sampling using NASA funding was initiated in 1994. Here, we summarize the results of our sampling to the end of the initial sampling period (December 1995).

OBJECTIVES

This study has the following major objectives:

(1) **Inventory of herpetological communities**: The foremost goal of this study is to provide NASA, the NPS, and the USFWS with an accurate and quantified inventory of the species of reptiles and amphibians present at the KSC/MINWR/CNS with specific attention given to species which are currently or potentially considered endangered or threatened.

(2) **Evaluation of survey techniques**: An essential goal of this study is to develop a inventory and monitoring methodology that can be used by Dynamac, the NPS, or other federal personnel to determine changes in amphibian and reptile populations over time. Emphasis will be on developing a simplified methodology that will permit personnel with only limited training in herpetology to establish their own survey/monitoring programs for reptiles and amphibians.

(3) **Identification of species-specific habitat requirements**: A third goal of this study is to determine the specific habitat requirements of reptiles and amphibians at the KSC/MINWR/CNS. This will provide NASA, NPS, and USFWS with essential information on the impacts of various activities on herpetological communities, and will facilitate establishment of management programs for key species.

(4) **Develop a long-term monitoring program**: The final goal of this study is the establishment of a long-term monitoring program of reptiles and amphibians on selected units of the KSC/MINWR/CNS. Such a monitoring program will be modeled after the design currently being developed at the Gulf Islands National Seashore, but will be somewhat more complex owing to the higher diversity of reptiles and amphibians at the KSC/MINWR/CNS.

MATERIALS AND METHODS

A) **Collecting methods**

We used a combination of the following methods in 1994-1995, listed in rough order of emphasis and success;

(1) Hand-collecting-- Although hand-collecting is the least quantitative method of sampling amphibians and reptiles, it is essential in developing a thorough inventory (Seigel and Doody, 1995). Specific methods used included carefully turning and replacing ground cover, time-constrained hand-collecting, seining of small ponds, and spotlight surveys of aquatic habitats by hand or from small boats or canoes.

(2) Road-collecting-- Because many amphibians and reptiles cross roads during their normal activities, sampling amphibians and reptiles from a vehicle, especially at night, allows for a large sample at relatively little investment of time and resources. In addition, because there is an existing data set from 1977-1979 based on road-collecting at KSC/MINWR/CNS, road sampling allows a quantitative comparison between these sampling periods for both overall abundance and relative abundance.

Although all amphibians and reptiles found on road were processed (see below), we also conducted intensive sampling along the triangle formed by Rts. 402, 406, and 3, the areas sampled by R. Seigel during 1977-1979.

(3) Aquatic trapping- Tadpoles, aquatic salamanders, and aquatic snakes were sampled using unbaited minnow traps, set in shallow areas along the shoreline of ponds and marshes. These minnow traps were highly effective in capturing aquatic snakes at the KSC/MINWR/CNS during our 1992 surveys, and were highly effective this year as well (see below). In addition, we

used standard baited hoop traps (Plummer, 1979) as our primary method of catching turtles, but this was less successful.

(4) Drift Fences- We established four drift fence arrays during 1994-95, two in the Happy Creek area, one near the so-called Turning Basin, and one along Wisconsin Village Road. Two arrays were set in scrub habitat, one bordering an ephemeral wetlands, and the forth set along a levee. Fences were equipped with a combination of 18.9-liter plastic buckets (which act as pitfall traps) and paired funnel traps. Pitfall traps catch mainly salamanders, frogs, turtles, lizards, and small snakes, whereas funnel traps catch primarily larger snakes. A large sponge was placed in each pitfall trap to decrease the possibility of mortality among amphibians. Both pitfall traps and funnel traps are covered by a small board to reduce exposure to the sun. Drift fences were checked daily during specified sampling periods throughout the year..

(5) Artificial Shelters- We established four coverboard arrays at KSC/MINWR/CNS during 1994-95, one along Wisconsin Village Road, one at Oak Hill, one north of Haulover Canal near a wetlands known as the "Northern Swale", and one along the Oak Hammock Trail. Each plot had 35-40 coverboards, each 91 x 91 x 5 cm. Arrays at Oak Hill and at Wisconsin Village Road were set in pairs of wooden and metal shelters, whereas the arrays at the Northern Swale and along the Oak Hammock Trail used wooden boards only. Each array was checked two times per week.

(6) Frog Breeding Surveys: The fact that frogs congregate for breeding allows for highly effective inventories of these species. We surveyed seven major (swales, ponds) and 13 minor (ditches, canals) aquatic habitats for breeding sites for frogs during 1994-95.

B) **Processing of individuals**

All reptiles and amphibians captured were identified, sexed, and released at point of capture. Turtles and snakes were also measured (length and mass), checked for reproductive condition, and released. All turtles and some aquatic snakes were given an individual mark by drilling holes in marginal scutes (turtles) or clipping ventral scales (snakes).

RESULTS AND DISCUSSION

A) **Species Inventory**

Since initiation of sampling in 1992, we have identified 62 species of reptiles and amphibians (exclusive of marine turtles) at KSC/MINWR/CNS (Table 1). In comparison, Ehrhart (1976) reported only 55 species of reptiles and amphibians, exclusive of sea turtles. We found 10 species not reported in Ehrhart's earlier summary (Table 1). Some of these (e.g., brown anoles, Indo-Pacific geckos, and Mediterranean geckos) probably represent recent introductions to the site, whereas others (e.g., black swamp snakes, island glass lizards, two-toed amphiumas, and red-spotted newts) probably were found because of the broader array of sampling methods employed in this study. For example, the striped crayfish snake was seen very rarely during the late 1970's (one observation between 1977-1979), whereas this species was found to be common when sampling with aquatic snake traps (28 records to date).

B) **Effectiveness of Sampling Methods**

We processed 2088 reptiles and amphibians during 1994-95. Table 2 lists the results of our major sampling methods. In rank order of total numbers of animals handled, road-collecting was the most effective method, followed by hand-collecting, minnow traps, coverboards, drift fences, and turtle traps. There were also major differences among methods in terms of the numbers of species sampled (Fig. 1). In general, the methods which were most successful in sampling large numbers of individuals also sampled large numbers of species (e.g., road-collecting resulted in 38 species whereas drift fences resulted in only 12 species).

As noted by other authors (e.g., Fitch, 1992), collecting methods for amphibians and reptiles tend to be complementary to each other. For example, despite the overall success in road collecting, there were 12 species captured via hand collecting that were not captured via road collecting. In addition, spadefoot toads were collected only by using drift fences, and 108 of the 109 greenhouse frogs captured were found under coverboards. Hence, although some methods resulted in both a higher number of individual records and number of species, a complete inventory and monitoring program is only possible using a broad array of techniques.

C) **Changes in relative abundance**

One of the major goals of this study is to determine long-term changes in the abundance of amphibians and reptiles of the KSC/MINWR/CNS, based on data collected in the 1970's by Ehrhart (1976) and by Seigel (Unpubl.). However, the primary sampling methods used in the 1970's were hand-collecting and road-collecting, so any valid comparisons between these sampling periods can only be made using these methods.

Although any statistical analysis must await the collection of additional data, our road-collecting data from 1994-95 show some interesting changes in the relative abundance of some species of reptiles (Table 3). For example, Seigel (unpubl. data) found that ribbon snakes (Thamnophis sauritus) comprised over 50% of the total snakes found by road-collecting between 1977 and 1979, whereas garter snakes (T. sirtalis) comprised only 4.4% of his sample (Table 3).

By contrast, data from 1994-95 shows that garter snakes represented 19.4% of the road-collected sample, whereas ribbon snakes decreased to only 32.4% (Table 3). Other species showing an apparent decline in relative abundance include green water snakes and cottonmouths. Conversely, increases were noted in the relative abundance of corn snakes and mud snakes.

Interpreting these apparent changes is difficult, but three possibilities represent likely explanations; First, these changes may merely represent sampling error; this possibility can be discounted by collecting additional data in 1996-97. Second, these changes may represent minor temporal fluctuations unrelated to human-caused effects. Pechmann et al. (1992) and Seigel et al. (1995) cautioned against interpreting changes in reptile and amphibian populations as human-caused without sufficient data. Finally, these changes may be the result of human effects, especially habitat modifications (e.g., impoundments, road construction) and road mortality. Although we are aware of no major habitat modifications along the routes surveyed, road mortality remains a serious concern; a relatively high proportion of the snakes (about 33%) sampled during this study were found dead. Whether road-mortality could cause the kinds of changes seen in this study remains unknown.

D) **Effect of introduced bacterial disease on gopher tortoise populations**

Although not part of our specific goals, we obviously view potential threats to amphibian and reptiles populations of the KSC/MINWR/CNS a critical management issue. One such threat is the spread of a highly infectious bacterial infection of gopher tortoises referred to as Upper Respiratory Tract Disease or URTD (Jacobson et al., 1991; Brown et al., 1994). Originally found in desert tortoises, this disease is now widespread in Florida and is known from as far west as

Mississippi (K. Smith and Seigel, unpubl. data). The disease has a very high infection rate, and may cause mortality in as many as 80% of the tortoises infected (G. McClocklin, pers. comm.).

A likely mechanism for transmitting URTD is through the introduction of infected tortoises into colonies by members of the public, who may frequently release pet tortoises into natural areas such as the KSC/MINWR/CNS. Given the potential for this infection to decimate otherwise stable gopher tortoise populations, we conducted a preliminary study designed to determine the occurrence and prevalence of URTD for tortoises at the KSC/MINWR/CNS.

Several sites on KSC/MINWR/CNS were chosen as target areas for obtaining gopher tortoises for testing, both in and out of the security zone. Sites outside of security zone included Dummit Grove (located just south of Haulover Canal along Rt. 3), the Playalinda Beach Road, and Rt. 3 north of the security zone. Collecting sites inside security zone included the NASA Beach Road (located south of Playalinda Beach), Happy Creek, TEL-4, and the Turning Basin site, located southeast of the VAB. The latter site is much more isolated and less available to KSC employees than the other sites sampled.

Tortoises were captured mainly be hand or through the use of wire traps and buckets. Active burrows at the Dummit Grove and Turning Basin sites were trapped with either large wire cage traps (42"x15"x15") placed at the mouth of the burrow or using five-gallon buckets buried in front of the burrow. Nine cage traps and nine bucket traps were used at Dummit Grove and nine cage traps and seven bucket traps were used at the Turning Basin. Tortoises at the Beach Road site and any tortoises seen during trips to and from the trap sites were hand captured.

Once a tortoise was captured, it was taken to the field lab to be measured, weighed, and permanently marked. Approximately 1 cc of blood was drawn from the brachial vein, centrifuged, and the plasma pipetted off and refrigerated. Tortoises were released at the point of capture. Analysis of the plasma was done by the BEECS Immunological Analysis Laboratory, University of Florida, Gainesville. A serological test that measures the amount of antibody specific to *Mycoplasma agassizii* was used to determine if a tortoise had been exposed to URTD (BEECS 1995).

Between April and July 1995 we obtained blood from 62 individual tortoises (29 males and 33 females). 30 tortoises (48%) were positive for *Mycoplasma agassizii*, eight were suspect or borderline, and 24 were negative. The frequency of positive tests varied significantly between males and females, with males more likely to be positive or suspect than were females (Table 3: $G = 3.92$, $df = 1$, $P = 0.048$). Geographically, positive or suspect tortoises were found both in and out of the security zone; high rates of positive or suspect results were found at TEL-4 (100% of six tortoises), Canaveral National Seashore (83% of six tortoises), the CCAS (75% of four tortoises), and the NASA Beach Road (57% of 14 tortoises). Conversely, low rates of infection were found at the Turning Basin (zero of four tortoises) and Dummit Grove (zero of five tortoises).

During sampling in June and July 1995, we found five tortoises that showed signs of an active infection, including puffy eyes and a copious nasal discharge. This indicates that active URTD is present at the KSC/MINWR/CNS. One of these sick tortoises was found dead in the fall of 1995, although a cause of death could not be determined.

The long-term effect of URTD on tortoise populations in the wild is unknown; however, it is imperative that the various management agencies at the KSC/MINWR/CNS begin to consider how this problem might be dealt with. For example, thought should be given to ways of notifying the public not to release any tortoises from off-site, whether they are apparently ill or not. Relocations within the KSC/MINWR/CNS should probably be discouraged, or, at least, should only be conducted after blood tests have been conducted. Finally, additional research on the effects of URTD on natural populations is needed urgently.

E) **Plans for 1996**

Emphasis in 1996 will be placed on the following: (1) Initiation of research on the effects of Upper Respiratory Tract Disease on gopher tortoise populations, (2) Studies on the causes of apparent declines of selected species, especially snakes and turtles, and (3) Initiation of a long-term monitoring program on selected species. This latter objective will utilize most of the collecting methods tested during 1994-95, and will provide NASA and other management agencies with a long-term database to determine population trends of selected species.

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Table 1. Current inventory of amphibians and reptiles of the KSC/MINWR/CNS. Data collected from 1992-1995 are compared with the list provided by Ehrhart (1976). Species marked with an "*" were not found by Ehrhart (1976). Marine turtles are not listed here.

Species	Ehrhart , 1976	Seigel and Demuth, 1995
Alligator mississippiensis (American alligator)	+	+
Chelydra serpentina (snapping turtle)	+	+
Kinosternon bauri (striped mud turtle)	+	+
Kinosternon subrubrum (mud turtle)	+	+
Deirochelys reticularia (chicken turtle)	+	+
Pseudemys peninsularis (Florida cooter)	+	+
Pseudemys nelsoni (Florida redbelly turtle)	+	+
Malaclemys terrapin (diamondback terrapin)	+	+
Terrapene carolina (box turtle)	+	+
Apalone ferox (Florida softshell turtle)	+	+
Gopherus polyphemus (gopher tortoise)	+	+
*Anolis sagrei (brown anole)	-	+
Anolis carolinensis (green anole)	+	+
Cnemidophorus sexlineatus (racerunner)	+	+
*Hemidactylus garnoti (Indo-Pacific gecko)	-	+
*Hemidactylus turcicus (Mediterranean gecko)	-	+
Scincella lateralis (ground skink)	+	+
Eumeces inexpectatus (southeast five-lined skink)	+	+
Eumeces egregius (mole skink)	+	-
Ophisaurus attenuatus (eastern glass lizard)	+	-
*Ophisaurus compressus (island glass lizard)	-	+
Ophisaurus ventralis (slender glass lizard)	+	+
Cemophora coccinea (scarlet snake)	+	+
Diadophis punctatus (ring-necked snake)	+	+
Heterodon platirhinos (eastern hog-nosed snake)	+	+
Lampropeltis getula (common kingsnake)	+	+
Masticophis flagellum (coachwhip)	+	+
Coluber constrictor (racer)	+	+
Thamnophis sirtalis (garter snake)	+	+
Thamnophis sauritus (ribbon snake)	+	+
*Nerodia clarkii (Atlantic saltmarsh snake)	-	+
Nerodia fasciata (banded water snake)	+	+
Nerodia floridana (green water snake)	+	+
Regina alleni (striped crayfish snake)	+	+
*Seminatrix pygaea (black swamp snake)	-	+
Farancia abacura (mud snake)	+	+
Storeria dekayi (brown snake)	+	+
*Tantilla relicta (coastal dunes crowned snake)	-	+
Elaphe obsoleta (yellow rat snake)	+	+
Elaphe guttata (corn snake)	+	+
Crotalus adamanteus (diamondback rattlesnake)	+	+
Sistrurus miliarius (pygmy rattlesnake)	+	+
Agkistrodon piscivorus (cottonmouth)	+	+
Drymarchon corais (indigo snake)	+	+
Opheodrys aestivus (rough green snake)	+	+
Pituophis melanoleucus (pine snake)	+	+

Species	Ehrhart , 1976	Seigel and Demuth, 1995
*Micrurus fulvius (coral snake)	-	+
*Amphiuma means (two-toed amphiuma)	-	+
Siren lacertina (greater siren)	+	+
Siren intermedia (lesser siren)	+	-
*Notolphthalmus viridescens (red-spotted newt)	-	+
Eleutherodactylus planirostris (greenhouse frog)	+	+
Scaphiopus holbrooki (spadefoot toad)	+	+
Acris gryllus (cricket frog)	+	+
Pseudacris nigrita (chorus frog)	+	+
Pseudacris ocularis (little grass frog)	+	+
Hyla cinerea (green tree frog)	+	+
Hyla femoralis (pinewoods tree frog)	+	+
Hyla gratiosa (barking tree frog)	+	+
Hyla squirella (squirrel tree frog)	+	+
Rana grylio (pig frog)	+	+
Rana utricularia (leopard frog)	+	+
Bufo terrestris (southern toad)	+	+
Bufo quercicus (oak toad)	+	+
Gastrophryne carolinensis (narrow-mouthed toad)	+	+

Table 2. Comparison of effectiveness of different sampling methods used for inventorying amphibians and reptiles at the KSC/MINWR/CNS during 1994-1995. See text for discussion of the pros and cons of each method.

Reptiles	ROAD RUNNING	HAND COLLECT	MINNOW TRAPS	COVER BOARD	DRIFT FENCES	TURTLE TRAPS	**Totals**
American alligator	12					5	**17**
snapping turtle	1						**1**
striped mud turtle	5						**5**
common mud turtle	1						**1**
Florida redbelly turtle	4						**4**
Florida cooter	19	2					**21**
chicken turtle	4	1			1		**6**
diamondback terrapin	9						**9**
box turtle	45						**45**
Florida softshell turtle	14					3	**17**
gopher tortoise	194	21				5	**220**
brown anole		5			19		**24**
green anole	1	45		2			**48**
Indo-Pacific gecko		171					**171**
Mediterranean gecko		1					**1**
southeast five-lined skink		3		12			**15**
ground skink		54		127			**181**
race-runner		64		6	12		**82**
slender glass lizard	1	1		1			**3**
eastern glass lizard		1		1			**2**
island glass lizard	1	1					**2**
garter snake	41		12		4		**57**
ribbon snake	49	7	29	2	2		**89**
green water snake	3		2				**5**
banded water snake	20		91				**111**
brown snake	3						**3**
striped crayfish snake	3		25				**28**
black swamp snake			5				**5**
mud snake	4		7				**11**
coachwhip	2						**2**
black racer	31	2		1			**34**
yellow rat snake	5	2		1			**8**
corn snake	17	5					**22**
rough green snake	8	1					**9**
Florida pine snake		1					**1**
scarlet snake	1						**1**
ringneck snake	2			1	1		**4**
coastal dunes crowned snake				1			**1**
eastern indigo snake	7	2					**9**
cottonmouth	9	1					**10**
diamondback rattlesnake	4						**4**
coral snake	2						**2**
Total reptiles processed	**522**	**391**	**171**	**155**	**39**	**13**	**1291**
Number of Reptile Species	**32**	**21**	**7**	**11**	**6**	**3**	**42**

Amphibians	ROAD RUNNING	HAND COLLECT	MINNOW TRAPS	COVER BOARD	DRIFT FENCES	TURTLE TRAPS	Totals
two-toed amphiuma			9				**9**
greater siren			26				**26**
red-spotted newt			1				**1**
greenhouse frog		1		108			**109**
spadefoot toad					45		**45**
cricket frog			1				**1**
chorus frog							**0**
little grass frog	41	3					**44**
green tree frog	41	11	27				**79**
pinewoods tree frog		3			13		**16**
barking tree frog		1					**1**
squirrel tree frog	46	6	4		7		**63**
southern toad	5	3			1		**9**
oak toad		113			27		**140**
narrow-mouth toad		1		3	16		**20**
pig frog	6	2	100+				**108**
leopard frog	18	8	100+				**126**
Total amphibians processed	**157**	**152**	**268**	**111**	**109**	**0**	**797**
Number of Amphibian Species	**6**	**11**	**8**	**2**	**6**	**0**	**17**

	ROAD RUNNING	HAND COLLECT	MINNOW TRAPS	COVER BOARD	DRIFT FENCES	TURTLE TRAPS	Totals
Total amphibians and reptiles processed	**679**	**543**	**439**	**266**	**148**	**13**	**2088**
Number of Species	**38**	**32**	**15**	**13**	**12**	**3**	**62**

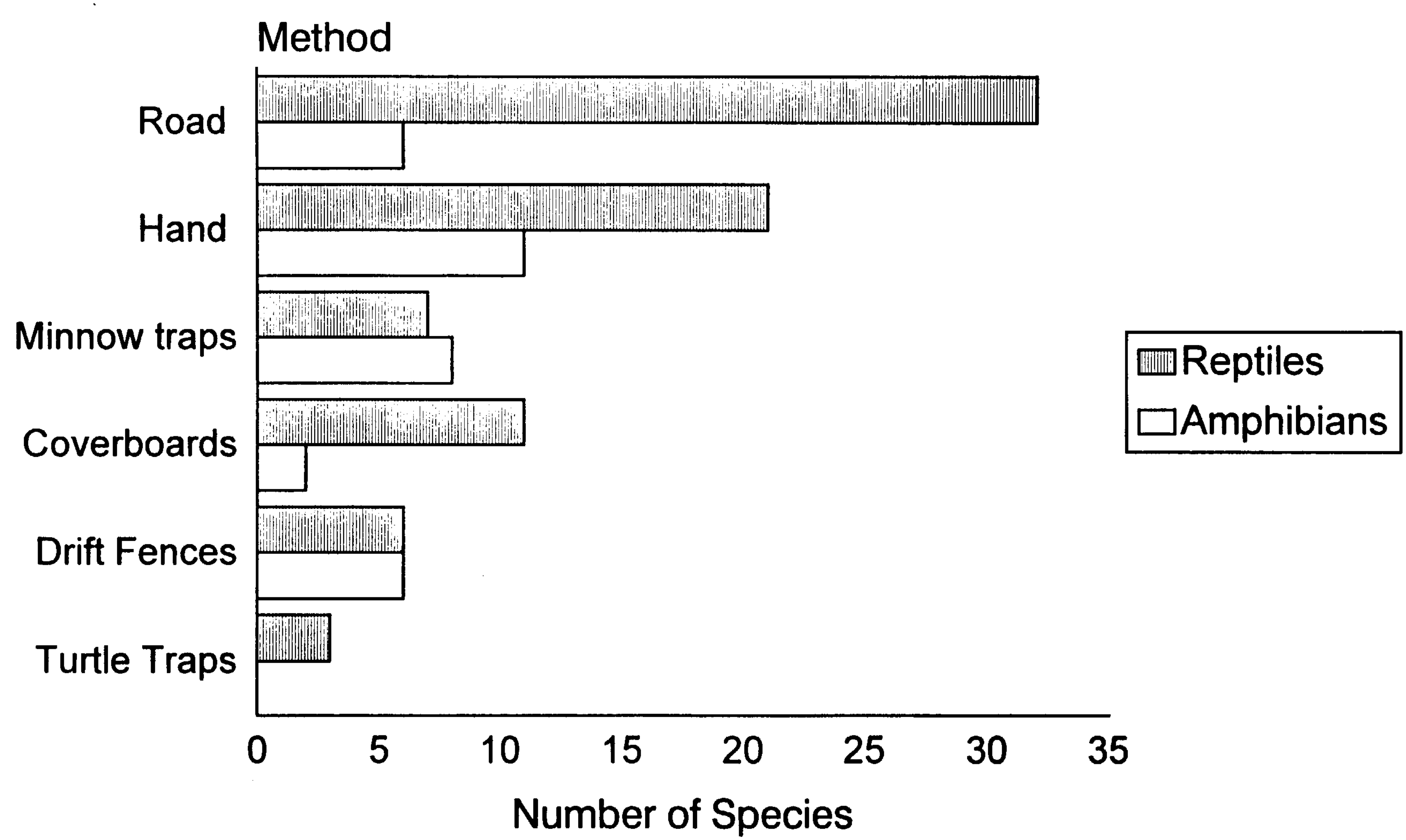
Table 3. Differences in relative abundance of snakes captured by road-collecting between the late 1970's and the 1990's. All records come from samples taken along the triangle formed by Rts. 3, 402, and 406. All sampling methodologies were identical, so differences should reflect real changes in relative abundance. Numbers of each species are followed by percent of total sample in parenthesis.

Species	1977-1979	1992-1995
Cemophora coccinea (scarlet snake)	1 (0.7%)	1 (0.9%)
Diadophis punctatus (ring-necked snake)	0 (0.0%)	2 (1.9%)
Heterodon platirhinos (eastern hog-nosed snake)	1 (0.7%)	0 (0.0%)
Lampropeltis getula (common kingsnake)	1 (0.7%)	0 (0.0%)
Coluber constrictor (racer)	8 (5.8%)	9 (8.3%)
Thamnophis sirtalis (garter snake)	6 (4.4%)	21 (19.4%)
Thamnophis sauritus (ribbon snake)	73 (53.3%)	35 (32.4%)
Nerodia fasciata (banded water snake)	15(10.9%)	15 (13.9%)
Nerodia floridana (green water snake)	6 (4.4%)	1 (0.9%)
Regina alleni (striped crayfish snake)	1 (0.7%)	2 (1.9%)
Farancia abacura (mud snake)	2 (1.5%)	5 (4.6%)
Storeria dekayi (brown snake)	1 (0.7%)	0 (0.0%)
Elaphe obsoleta (yellow rat snake)	2 (1.5%)	1 (0.9%)
Elaphe guttata (corn snake)	4 (2.9%)	8 (7.4%)
Crotalus adamanteus (diamondback rattlesnake)	2 (1.5%)	3 (2.8%)
Agkistrodon piscivorus (cottonmouth)	13 (9.5%)	2 (1.9%)
Drymarchon corais (indigo snake)	0 (0.0%)	1 (0.9%)
Opheodrys aestivus (rough green snake)	1 (0.7%)	2 (1.9%)
	N=137	N=108

Table 4. Summary of sexual differences in results for blood tests for URTD during 1995. The differences between the sexes were statistically significant. See text for discussion.

Sex	# Positive	# Negative	# Suspect	Totals
Males	19	9	5	33
Females	11	15	3	29
Totals	30	24	8	62

Fig. 1. Comparison of the number of species found using each technique for inventorying amphibians and reptiles at the KSC/MINWR/CNS during 1994-1995. See text for discussion of the pros and cons of each method.



Method
Road
Hand
Minnow traps
Coverboards
Drift Fences
Turtle Traps
0
5
10
15
20
25
30
35
Number of Species
Reptiles
Amphibians